SPRT LCD Terminal

User's Manual

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Chapter 1 Introduction

LCD terminal as the crystallization of the contemporary high-tech products, which has not only ultra-thin flat, color fidelity, but also small size, power consumption provinces, long life, non-ray, earthquake, explosion-proof, and many other advantages, is the ideal replacement display for industrial instrumentation, electrical and mechanical equipment and other industries.

The LCD terminal is very easy to use, you only need to send the character or Chinese characters through the serial interface to the terminal, then the character or Chinese characters will be shown on the terminal in accordance with the size, direction, location that had been set. It is very convenient to draw dots, straight lines, rectangles, circles and arcs, and so on. From top to bottom, from left to right to screen displaying function allows you show continuous curve more speedily and conveniently.

The terminal can not only show all ASCII characters, German, French, Russian, Japanese Katakana, mathematical symbols, special symbols, also can show the GB Library I, II Chinese characters. The terminal also provide a variety of functions to modify the characters: such as rotating, zooming, and character spacing, line spacing adjustment, scintillation, negative direction and so on.

In addition, the terminal also has the function that shows the preset graphics. You simply write the prepared BMP image files into E2ROM of the terminal for preservation. When need to demonstrate, the user just need to use the graphic command to display it.

Chapter 2 Performance and Interface

Section 1 Specification

1. Display dot: 320×240 pixels
2. Display color：Monochrome (blue and white)
3. Working Voltage：DC5V
4. Max. Power：5V×950mA
5. Operating Temperature：0～50℃
6. Saving Temperature：-20℃～60℃
7. Relative humidity：＜60％

All of the type of terminal exterior, please refer to the forth chapter.

Section 2 Serial Interface Description

The serial interface of SPRT LCD Terminal is 5-pin single row socket, through the W5、W6、W7 to select the TTL or RS232C level.

When W5, W6, W7 are 1,2 shorted at TTL level and 2,3 shorted at RS232C Level (W5, W6, W7 both have white spots one end of 1). When it is ex-factory, it should select RS232C level.

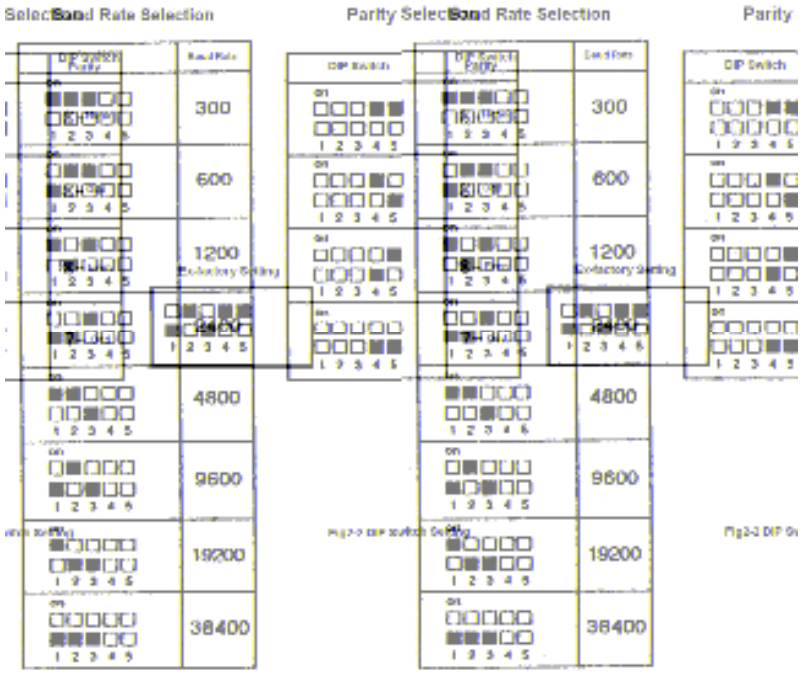
All-pin serial interface signals are defined as follows:

Pin	Signal	Direction	Description
1	DSR	Output	This signal is the "SPACE" status, which means the terminal is " On-line"
2	TXD	Input	When use the X-0N/X-OFF protocol，the terminal sends the control code (X-0N/X-OFF) to the host

3	RXD	Input	The terminal receives data from the host
4	CTS	Output	When this signal shows the "MARK", the terminal is busy and can't receive data; when it shows the "SPACE", the terminal is ready and can receive data
5	GND		Signal ground

Section 3 DIP Switch Setting

The baud rate for the terminal can be set by the DIP switch on the main circuit board, there are different baud rates: 300,600,1200,2400,4800,9600,19200 and 38400. You can set the baud rate according to the following table. The white spot means K1. The default baud rate is 9600B.P.S when it is ex-factory.



Serial interface communication format:

Start bit	Data bit	Parity bit	Stop bit
1	7/8	1	1

Both of the start and the stop bit are 1 bit. The data bit is 7 bit or 8 bit. Odd or even bit is 1 bit. When you select 7 bit data, only permit even parity. The ways of checking can be selected by K4 and K5 on the DIP switch, that you can refer to the table 2-3. The default is no parity when it is ex-factory, namely K4, K5=ON.

For serial interface, the RS-232 signal as follows:
MARK=Logic"1"(from EIA-3V to -27V low level)
SPACE=Logic"0"(from EIA+3V to +27V high level)

There are two handshaking ways to choose from, one way is mark control, the other way is the X-ON/X-OFF protocol. Please refer to the chart 2-4 for the description of the two handshaking ways.

Handshaking	Data direction	RS-232C signal
Mark control	Enter allowed	Signal "4"shows "Space"
	Enter permitted	Signal "4"shows "Mark"
X-ON/ X-OFF control	Enter allowed	Send X-ON code "11H" on the signal "3"
	Enter permitted	Send X-OFF code "13H" on the signal "3"

Table 2-3 Two Handshaking Ways

Please according to the following instructions to operate the serial interface:

(1)Use the DIP switch K1, K3 to select the baud rate;

(2)Use the DIP switch K4, K5 to select odd or even；

(3)Use the W5、W6、W7 to select interface level；

(4)When the terminal is busy, the signal line CTS (signal "4") will be set to "busy" by the terminal, and shows "Mark". Otherwise it is ready to receive data, and shows "SPACE":

(5)Under the control of X-ON/X-OF, in "busy" status, the terminal will send X-OFF (13H) code; in "ready" status, send X-ON(11H)code；

(6)Under the control of mark, the host will send or stop sending code string to the terminal according to the status "ready" or "busy".

Chapter 3 Command Format

Section 1 Command details

User can use the switch W8 on the control board to set the initial status of the terminal when it powers on. When W8 set to 1, 2 short circuit (the white spot means "1"), there is graphics showed on the screen if the graphics had been downloaded in. When W8 set to 2, 3 short circuit, there is no graphics.

[Select Character Set]

Format	ASCⅡ: ESC n
	Decimal: 27 n
	Hex: 1B n

Explanation: the value of n is31H～33H, the corresponding character set is 1, 2, 3. When the user wants to display character or Chinese character, he can select the corresponding character set by using this command, then

send the codes for the characters. The default setting is Character Set 3.

[Set Character Spacing]

Format	ASCⅡ: ESC Z n
	Decimal: 27 90 n
	Hex: 1B 5A n

Explanation:

This command is used to set the character spacing.

The value of n is 0～255, when the terminal is powered on or initialized, the character spacing is set to 0.

[Set Line Spacing]

Format	ASCⅡ: ESC H n
	Decimal: 27 72 n
	Hex: 1B 48 n

Explanation:

This command is used to set the line spacing.

The value of n is 0～255, when the terminal is powered on or initialized, the character spacing is set to 0.

[Clear Screen]

Format	ASCⅡ: ESC Q n
	Decimal: 27 81 n
	Hex: 1B 51 n

Explanation:

When n=0, the terminal clears all the data on the screen, then the system coordinate returns to （0, 0）;

When n=1, the terminal only clears the negative data on the screen, the system coordinate doesn't change.

When n=2, the terminal only clears the twinkling data on the screen, the system coordinate doesn't change.

[Carriage Return]

Format	ASCⅡ:CR
	Decimal:13
	Hex: 0D

Explanation:

This command is used to move the system coordinate to the left side. It means Y coordinate plus the height of character and line spacing, X coordinate changes to 0.

[Horizontal, Vertical Enlarging and Rotation Setting]

Format	ASCⅡ: ESC f n
	Decimal: 27 102 n
	Hex: 1B 66 n

Explanation:

This command is used to enlarge the character horizontally or vertically, and set the rotation angle of the character.

n.7, n.6, n.5: set the multiple of horizontal enlarging;

n.4, n.3, n.2: set the multiple of vertical enlarging;

n.1, n.0: set the rotation angle of the character.

Value / Multiple	n	Horizontal			Vertical		
		7	6	5	4	3	2
0		0	0	0	0	0	0
1		0	0	1	0	0	1
2		0	1	0	0	1	0
3		0	1	1	0	1	1
4		1	0	0	1	0	0
5		1	0	1	1	0	1
6		1	1	0	1	1	0
7		1	1	1	1	1	1

n.1, n.0=00(no rotation), 01(reverse rotation 90℃), 10(reverse rotation 180℃), 11(reverse rotation 270℃).

Notice: The 8×16 ASCII characters in Character Set 3 can be rotated. When the terminal is powered on or initialized, n is 0.

[Initialization]

Format	ASCⅡ: ESC @
	Decimal: 27 64
	Hex: 1B 40

Explanation:

After this command is set, the following items should be:

1. Character and line spacing is 0;
2. The multiple of horizontal or vertical enlarging is 0, no rotation;
3. The system coordinate is (0, 0);
4. Character set 3 is selected.

[Set System Coordinate]

Format	ASCⅡ: ESC z XL XH YL YH
	Decimal: 27 122 XL XH YL YH
	Hex: 1B 7A XL XH YL YH

Explanation:

This command is used to set the system coordinate, mainly used for defining the position to display characters and graphics.

XL: "X" low 8 bit XH: "X" high 8 bit

YL: "Y" low 8 bit YH: "Y" high 8 bit

The range of x coordinate value is 0～(horizontal dots of the screen -1)

The range of y coordinate value is 0～(vertical dots of the screen -1)

If the X system coordinate is set to the multiple of 8, it can improve the displaying speed.

[Draw Dot]

Format	ASCⅡ: ESC d XL XH YL YH
	Decimal: 27 100 XL XH YL YH
	Hex: 1B 64 XL XH YL YH

Explanation:

After this command is set, user can draw dots at any position on the screen.

[Draw Curve]

Format	ASCⅡ: ESC x X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Decimal: 27 120 X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Hex: 1B 78 X1L X1H Y1L Y1H X2L X2H Y2L Y2H

Explanation:

After this command is set, user can draw curve in any direction and length.

X1L, X1H, Y1L, Y1H: is the jumping-off coordinate of the curve drawn.

X2L, X2H, Y2L, Y2H: is the end point coordinate of the curve drawn.

[Draw Rectangle]

Format	ASCⅡ: ESC j X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Decimal: 27 106 X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Hex: 1B 6A X1L X1H Y1L Y1H X2L X2H Y2L Y2H

Explanation:

This command is used to draw rectangle.

X1L, X1H, Y1L, Y1H: is the coordinate of left upper corner of

the rectangular;

X2L, X2H, Y2L, Y2H: is the coordinate of right down corner of the rectangular.

Y1H.7 = 0: no filling; Y1H.7 = 1: Filled.

[Draw Circle and Round Arc]

Format	ASCⅡ: ESC y XL XH YL YH R
	Decimal: 27 121 XL XH YL YH R
	Hex: 1B 79 XL XH YL YH R

Explanation:

This command is used to draw the circle or round arc whose centre can be in any position of coordinate.

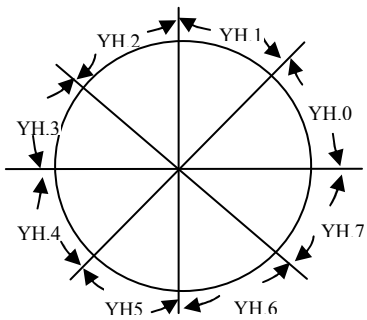


fig. 3.1

XL, XH， ,YL,YH: the coordinate of circle centre;

R: circle radius;

YH.7～YH.0: the corresponding section of the arc. Refer to fig 3.1;

YH.7 ～ YH.0: when the corresponding bit is 0, its corresponding arc will be displayed; when it is 1, the arc won't be displayed.

[Time-lapse]

Format	ASCⅡ: ESC l n
	Decimal: 27 108 n
	Hex: 1B 6C n

Explanation:

After this command is set, the terminal will delay n×0.1 second to receive data.

[Scroll Screen Upwards or Downwards]

Format	ASCⅡ: ESC h n
	Decimal: 27 104 n
	Hex: 1B 68 n

Explanation:

This command is used to enable the contents in full-screen scrolled upwards or downwards.

The value of n is -127～+127(dot), n.7=1: scroll the content upwards; n.7=0: scroll the content downwards.

[Scroll Screen Left or Right]

Format	ASCⅡ: ESC c n
	Decimal: 27 99 n
	Hex: 1B 63 n

Explanation:

This command is used to enable the contents in full-screen scrolled to the right or left side.

The value of n is -127～+127(dot), n.7=1: scroll the content to left side; n.7=0: scroll the content to right side.

[Delete]

Format	ASCⅡ: ESC s X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Decimal: 27 115 X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Hex: 1B 73 X1L X1H Y1L Y1H X2L X2H Y2L Y2H

Explanation:

This command is used to delete the content displayed in the rectangle frame.

X1L, X1H, Y1L, Y1H: is the coordinate of left upper corner of the rectangular;

X2L, X2H, Y2L, Y2H: is the coordinate of right down corner of the rectangular.

This command is invalid when the content is displayed flickeringly.

[Set Display Flickeringly]

Format	ASCⅡ: ESC S n

	Decimal: 27 83 n
	Hex: 1B 53 n

Explanation:

This command is used to enable or disable displaying flickeringly and the speed of flicker.

When n. 1, n.0: (0,0), flicker disabled. The data received won't flicker after this command is set, but the data received before this command set will be still flicker.

When n. 1, n.0: (0,1), flicker enabled. All the data received will flicker after this command is set.

n.2 control the speed of flicker. When n.2=1, fast; When n.2=0, slow.

When n. 1, n.0: (1,0), cancel flicker. All the data received won't flicker after this command is set.

When n. 1, n.0: (1,1), delete the content displayed flickeringly. All the data that is displayed flickeringly, also the data that has been cancelled to flicker will be deleted after this command is set.

[Set Reverse Display]

Format	ASCⅡ: ESC i X1L X1H Y1L Y1H X2L X2H Y2L Y2H
	Decimal: 27 105 X1L X1H Y1L Y1H X2L X2H Y2L Y2H

	Hex: 1B 69 X1L X1H Y1L Y1H X2L X2H Y2L Y2H

Explanation:

This command will enable the content in the designated rectangular frame reverse displaying.

X1L, X1H, Y1L, Y1H: is the coordinate of left upper corner of the rectangular;

X2L, X2H, Y2L, Y2H: is the coordinate of right down corner of the rectangular.

[Transfer Downloaded Bitmap Graphics]

Format	ASCⅡ: ESC P n
	Decimal: 27 80 n
	Hex: 1B 50 n

Explanation:

All of the displayed content can be divided into a fixed part and changeable part on the screen. For the fixed part, user can edit the graphics firstly in the PC, then download it into the E^2ROM of the terminal and save it, when it is needed, just transfer it by using this command. The E^2ROM chip the terminal used is 256k, it can save the data even power off. When the user transfer the n graphics, the value of n is (1～63). Before use this command, user needs to set the start point coordinate of the graphics by using command ESC z.

[Move Coordinate Upwards or Downwards]

Format	ASCⅡ: ESC a n
	Decimal: 27 97 n
	Hex: 1B 61 n

Explanation:

This command will move upwards or downwards the coordinate from the current position to the new position. "n" is the movement distance, the range of the value is -127～+127 dot. D7 is n's symbol bit, when D7=1, move downwards; D7=0, move upwards.

[Move Coordinate Left or Right]

Format	ASCⅡ: ESC b n
	Decimal: 27 98 n
	Hex: 1B 62 n

Explanation:

This command will move left or right the coordinate from the current position to the new position. "n" is the movement distance, the range of the value is -127～+127 dot. D7 is n's symbol bit, when D7=1, move right; D7=0, move left.

[Set Backlight]

Format	ASCⅡ: ESC B n
	Decimal: 27 66 n

	Hex: 1B 42 n

Explanation:

This command controls the backlight on or off. When n=1, turn off the backlight; When n=2, turn on the backlight.

[Copy Full Screen]

Format	ASCⅡ: ESC k n
	Decimal: 27 107 n
	Hex: 1B 6B n

Explanation:

User can use this command to copy the current full screen graphics to the memory chip of the terminal. When need to display the graphics, just use command 1B 4B n (Hex) to transfer it. n is the serial number of the copied graphics, the range of n value is 1～63.

[Display the Copied Full Screen]

Format	ASCⅡ: ESC K n
	Decimal: 27 75 n
	Hex: 1B 4B n

Explanation:

This command is used to transfer the copied full screen graphics which is saved in the memory chip of the terminal. n is the serial number of the copied graphics. As all the copied

graphics are full screen display, so before use this command, the user should set the system coordinate to (0, 0).
Note: When there are both downloaded graphics and copied screen graphics in the memory chip, as the commands which use to transfer these graphics are different, so the user should distinguish the serial number of these graphics.

Section 2 Index of Command

ASC Ⅱ	Hex	Description	Page
ESC n	1B n	Select Character Set	5
ESC Z n	1B 5A n	Set Character Spacing	6
ESC H n	1B 48 n	Set Line Spacing	6
ESC Q	1B 51	Clear Screen	6
CR	OD	Carriage Return	7
ESC f n	1B 66 n	Horizontal, Vertical Enlarging and Rotation Setting	7
ESC @	1B 40	Initialization	8
ESC z x y	1B 7A x y	Set System Coordinate	9
ESC d x y	1B 64 x y	Draw Dot	9

ESC x x1 y1 x2 y2	1B 78 x1 y1 x2 y2	Draw Curve	10
ESC j x1 y1 x2 y2	1B 6A x1 y1 x2 y2	Draw Rectangle	10
ESC y x y R	1B 79 x y R	Draw Circle or Round Arc	11
ESC l n	1B 6C n	Time-lapse	12
ESC h n	1B 68 n	Scroll Screen Upwards or Downwards	12
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ESC s x1 y1 x2 y2	1B 73 x1 y1 x2 y2	Delete	13
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ESC i x1 y1 x2 y2	1B 69 x1 y1 x2 y2	Set Reverse Display	14
ESC P n	1B 50 n	Transfer Downloaded Bitmap Graphics	15
ESC a n	1B 61 n	Move Coordinate upwards or downwards	16
ESC b n	1B 62 n	Move Coordinate	16

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ESC B n	1B 42 n	Set Backlight	16
ESC k n	1B 6B n	Copy Full Screen	17
ESC K n	1B 4B n	Display the Copied Full Screen	17

Chapter 4 Outline Dimension

The type of SPRT LCD Terminal as follows:

	SP-4DSA	SP-4DSC	SP-5DSA	SP-5DSB	SP-5DSC
Structure	LCD+Control Board	LCD+Control Board	LCD+Control Board	LCD+Control Board	LCD+Control Board
Control Board Size	Fig 4.1	Fig.4.1	Fig.4.2	Fig.4.2	Fig.4.2
LCD	SPRT50081	SPRT320240B	SPRT50174	SPRT320240C	SPRT320240D
LCD Size	Fig 4.3	Fig 4.4	Fig 4.5	Fig 4.6	Fig 4.7

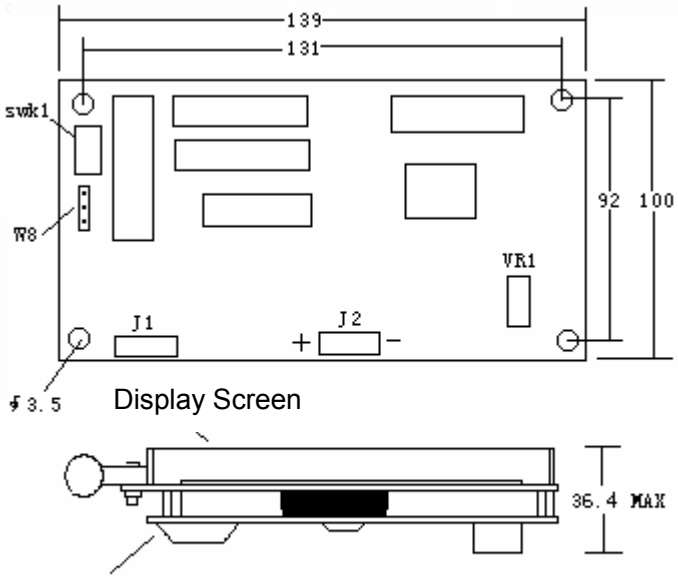


Fig. 4.1 Unit: mm

J1: Serial port (5-pin socket)

J2: Power supply port (4-pin socket)

SWK1: DIP switch

W8: Slip stitch, it is used to set whether there is graphics showed when power on.

VR1: Potentiometers, it is used to adjust the display contrast

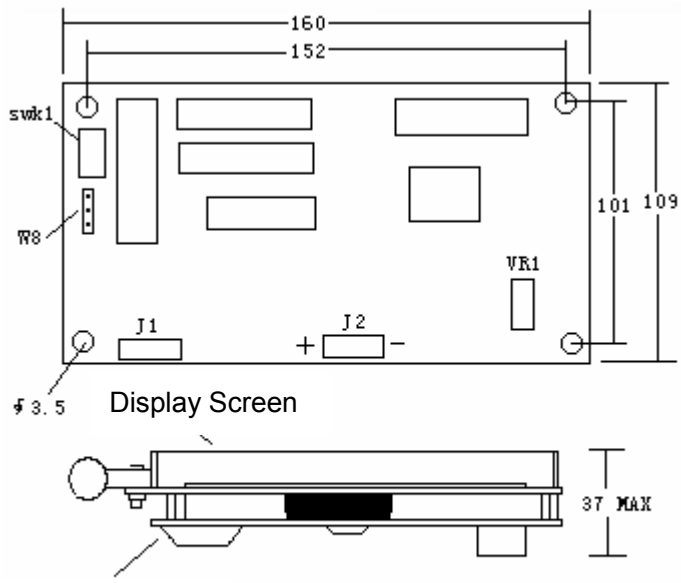


Fig. 4.2 Unit: mm

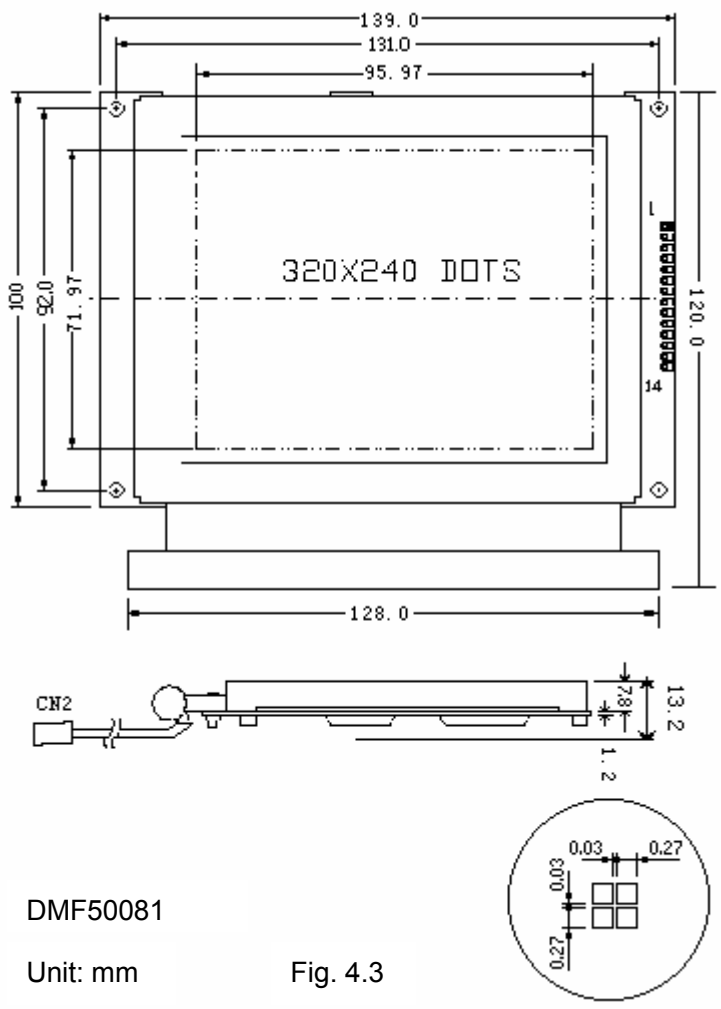
J1: Serial port (5-pin socket)

J2: Power supply port (4-pin socket)

SWK1: DIP switch

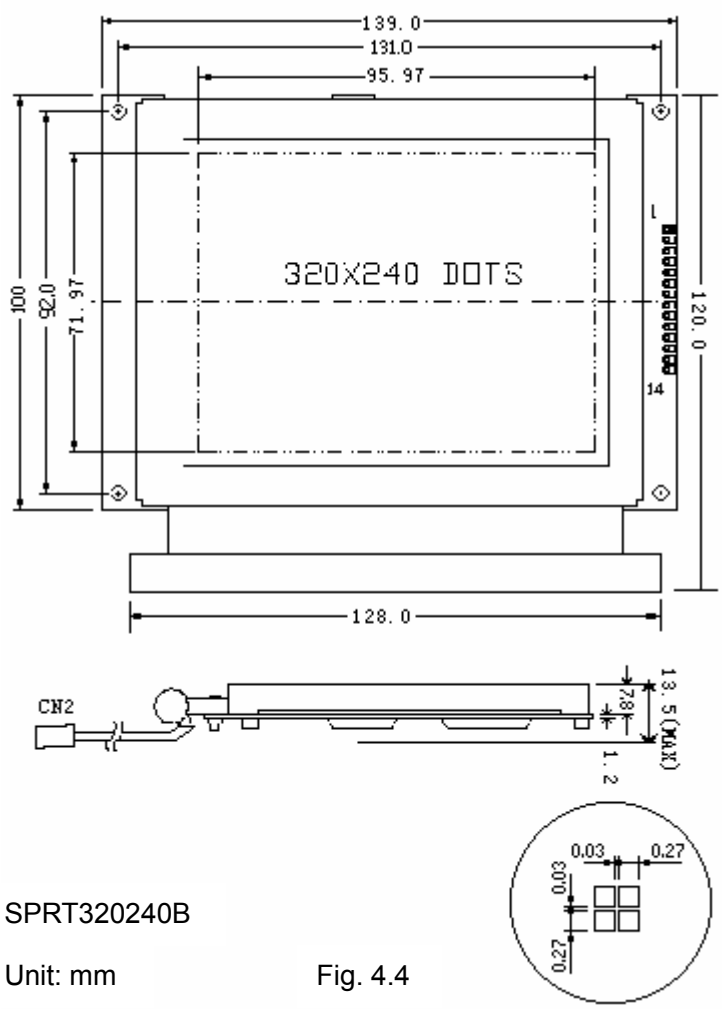
W8: Slip stitch, it is used to set whether there is graphics showed when power on.

VR1: Potentiometers, it is used to adjust the display contrast



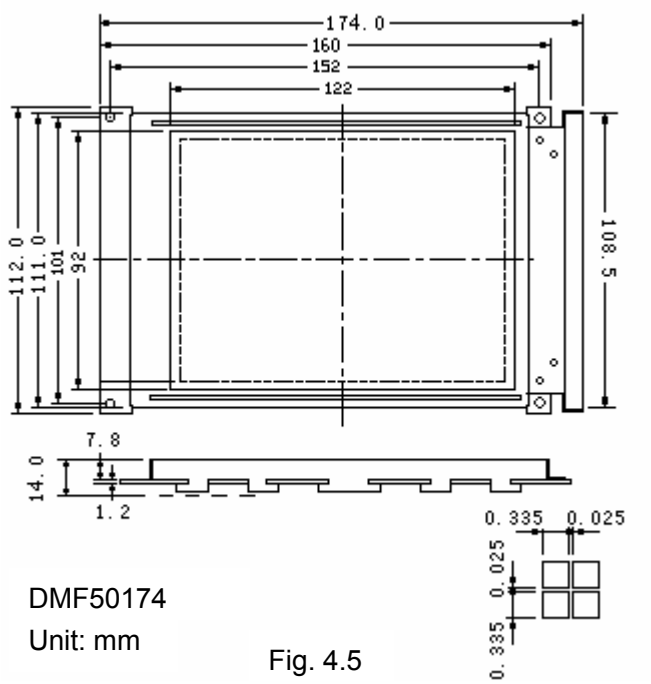
DMF50081

Unit: mm Fig. 4.3



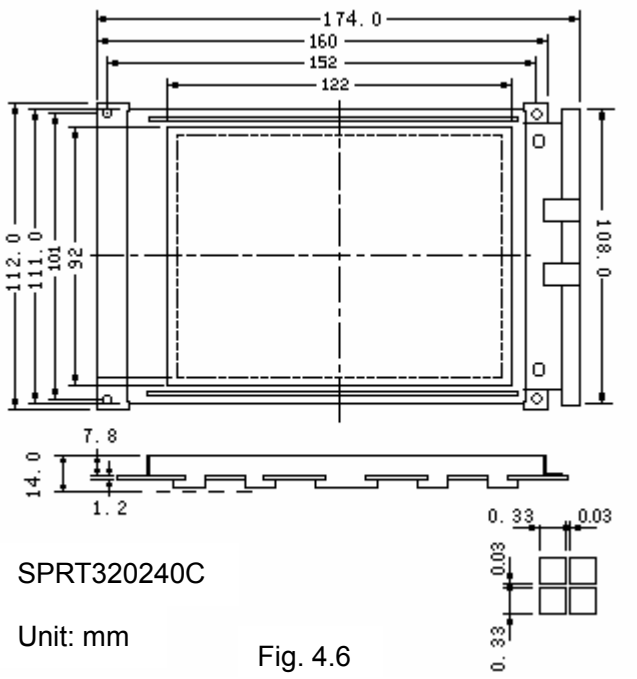
SPRT320240B

Unit: mm Fig. 4.4



DMF50174
Unit: mm

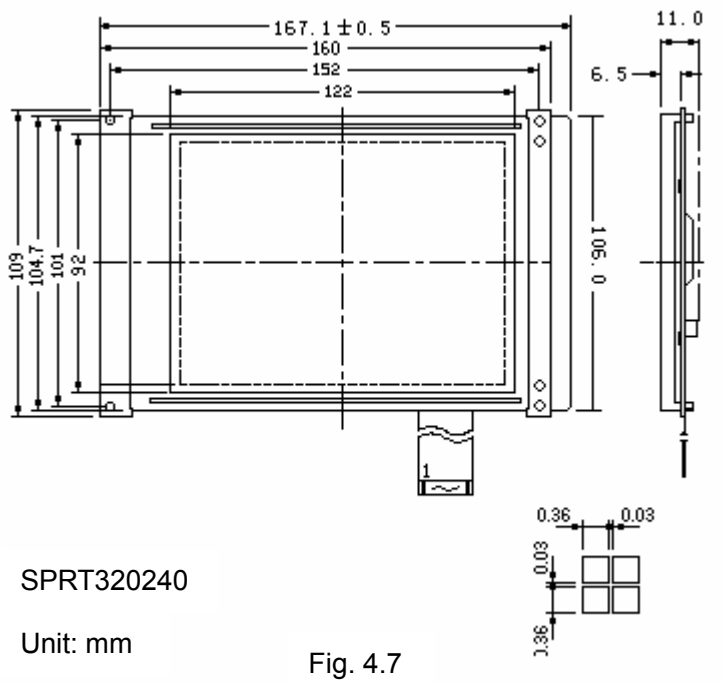
Fig. 4.5



SPRT320240C

Unit: mm

Fig. 4.6



SPRT320240

Unit: mm

Fig. 4.7

Chapter 5 Contrast and Lightness Adjustment

Section 1 Adjust Contrast

Method 1: When 2, 3 ports of W4 are short circuit, adjust the VR1 to change the contrast.

Method 2: When 2, 3 ports of W4 and 1, 2 ports of W3 are short circuit, can install a 20K adjustable resistance on the J4 socket to adjust the contrast.

Method 3: When 2, 3 ports of W4 are short circuit, use J2-2 to input terminal driving voltage, Vo=－10V～－22V，30mA.

Section 2 Adjust Lightness

When the terminal ex-factory, the default is 1, 2 ports of W3 and W1 are short circuit, the backlight power is provided by J2-1(DC+5V), the lightness is can't be adjusted.

Method 1: When 1, 2 ports of W2 are short circuit and W1 is disconnected, can install a changeable resistance(about10W，20Ω) on J3, thus user can adjust the lightness by adjusting the changeable resistance.

Method 2: When 2, 3 ports are short circuit and W1 is disconnected, can input a fixed DC power(such as DC+5V, DC+9V, DC+12V, 1A) from J2-3 port, and install a changeable resistance(about10W，20Ω) and a fixed resistance in series on J3, thus user can adjust the lightness by adjusting the changeable resistance.

Method 3: When 2, 3 ports are short circuit and W1 is disconnected, can input a changeable DC power (voltage from DC+3V to DC+7V, power about 10W), user can adjust the

lightness by adjusting the voltage.

Note1: The terminal only can use DC+5V adaptor, the current consumed by the control circuit is about 200mA, most of the current is consumed by the backlight lamp. If user wants to supply power to the backlight lamp separately or wants to control the on or off of the backlight, then can choose Method 3 to adjust.

Note 2: If the brightness of the backlight is too high, it would shorten the using time of the backlight lamp; also increase the power of the adaptor, so user should pay attention to avoid the brightness is too high.

Chapter 7 Security Instruction

To avoid incorrect operation or disposal, please notice these items as follows:

△Before you clean the display screen of the terminal, please close the terminal and computer firstly;

△Please make the display away from feculence、organic impregnant and dust, and use the soft and clean cloth to clean display termly;

△Please make sure the terminal is powered off when it needs to connect or disconnect the port or interface;

△Please make the display away from the sunshine or radiation;

△Avoid strong handling and falling on the ground

Appendix Character set 1, 2